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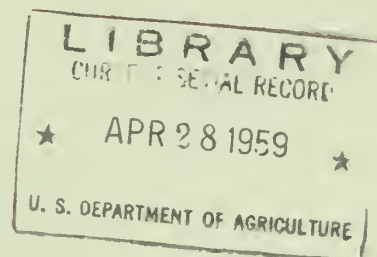
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UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service

BRUCELLOSIS VACCINATION SURVEY



BEEF CATTLE

Montana 1952-58

BOVINE
BRUCELLOSIS
ERADICATION

ARS-91-12
APRIL 1959

PREFACE

The purpose of the beef cattle survey in Montana was to establish the relative protection afforded by Strain 19 Brucella vaccine under conditions of beef animal husbandry as practiced in the State of Montana.

The data contained in this publication give information on the efficiency of Strain 19 Brucella vaccine in beef cattle, which will be useful to all veterinarians and others engaged in the brucellosis eradication program.

All data utilized in the preparation of this publication were assembled by the Livestock Sanitary Officials and their staff, of the State of Montana, in cooperation with the Animal Disease Eradication Division, ARS, USDA.

Prepared by

Animal Disease Eradication Division
Agricultural Research Service
United States Department of Agriculture

BRUCELLOSIS VACCINATION SURVEY--BEEF CATTLE

Montana 1952-58

At the time of the initial area brucellosis test in herds of the beef breeds in Montana, data was assembled for the purpose of evaluating the effect of vaccination on infection rates for both herds and cattle. In all, 951,014 cattle were tested, in 21,418 herds, of which 255,757 animals (26.89 percent) had been vaccinated against brucellosis, while 695,257 (73.11 percent) had not.

Separate herd categories were set up as follows: (1) No vaccination, (2) 1 to 25 percent of cattle vaccinated, (3) 26 to 50 percent of cattle vaccinated, (4) 51 to 75 percent of cattle vaccinated, (5) 76 to 99 percent of cattle vaccinated, and (6) 100 percent of cattle vaccinated.

Infection rates within the six herd classifications are set forth in Table I. Of the total 21,418 herds, 2,349 herds contained reactors. The percent of reactor herds is indicated within each of the six herd classifications. Of the nonvaccinated herds, only 9.48 percent contained reactors. The low infection rate is to be expected in this case, for there has been a common tendency to adopt a vaccination program only when brucellosis has been diagnosed or suspected.

Of the partially vaccinated herds we find the percentage of infected herds highest in the 1 to 25 percent vaccinated class (16.65 percent). The percentage decreases slightly in the 26 to 50 percent vaccinated class (to 15.60 percent), then drops, but not significantly, in the 51 to 75 percent class (to 15.58 percent). There is a perceptible drop in the percentage of infected herds among the 76 to 99 percent vaccinated class (to 14.26 percent). A highly significant drop (to 7.28 percent) in the percentage of infected herds among the 100 percent vaccinated herds is an indication of a number of known and unknown factors. It is possible that vaccination of all of the cattle in these herds has been instrumental in freeing a few from brucellosis. We would expect husbandry practices and all factors of sanitation and management to be more adequate in herds where there is enough interest to assure vaccination of all replacements. It is probable that the vaccination program has been in operation for a relatively longer period of time in 100 percent vaccinated herds as compared to partially vaccinated herds, with the benefits of a prolonged vaccination program accruing to the herds within the former classification. Since the data presented were gathered at the time of the first test conducted in the official area brucellosis eradication program, they do not include prior information on private herd control programs. We may assume that private control programs would perhaps be more diligently pursued in the nonvaccinated and the 100 percent vaccinated classes than in the partially vaccinated classes, but their effect cannot be truly measured.

Table I includes data on the distribution of herds containing suspects to the brucellosis test, but no reactors, among the various herd classifications. It is interesting

TABLE I
Brucellosis as Distributed Through Herd Population in
Relation to Herd Vaccination Practices

Herd Vaccination Status	Negative herds		Reactor herds		Herds contain- ing suspects but no reactors		Total herds	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Nonvaccinated	11,102	84.38	1,248	9.48	807	6.14	13,157	61.43
1-25 pct. vaccinated	2,025	69.52	485	16.65	403	13.83	2,913	13.60
26-50 " "	992	68.18	227	15.60	236	16.22	1,455	6.79
51-75 " "	579	68.85	131	15.58	131	15.57	841	3.93
76-99 " "	364	71.09	73	14.26	75	14.65	512	2.39
100 " "	2,081	81.93	185	7.28	274	10.79	2,540	11.86
Totals	17,143	80.04	2,349	10.97	1,926	8.99	21,418	100

TABLE I-A

Herd group	Negative herds		Reactor herds		Herds contain- ing suspects but no reactors		Total herds	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
All partially vaccinated herds	3,960	69.22	916	16.01	845	14.77	5,721	26.71
All nonvaccinated and partially vaccinated herds	15,062	79.79	2,164	11.46	1,652	8.75	18,878	88.14

to note that the percentage of "Suspect Only" herds does not increase in relation to the increase in percentage of vaccinated animals within the herds. A significant drop is noted in the 100 percent vaccinated class. This would seem to indicate that vac-
cinal titers are not a primary cause for the presence of suspect animals in herds
containing only suspects.

Table I indicates the percentage of all herds found in each of the six classifications. From this information it would seem that there is a tendency toward the vaccination of all calves in the herd if a vaccination program is adopted. This would seem to be a wise course when we consider the decreased infection rate among the 100 percent vaccinated class.

Table IA contains a portion of the same information as Table I, but it is grouped according to two separate classifications. The first, "All Partially Vaccinated Herds", contains a summary of the herds which fall into the 1 to 99 percent vac-
cinated classes. The second, "All Nonvaccinated and Partially Vaccinated Herds" groups all herds except those which were 100 percent vaccinated. The two groupings in Table IA allow interesting comparisons.

Cattle infection rates within each of the six herd classifications are set forth in Table II. Of a total of 951,014 cattle, there were 8,730 reactors (0.92 percent infection rate). The percent of infected animals is indicated within each of the six herd classifications. The 1.06 percent reactors in nonvaccinated herds is a comparatively low infection rate when we consider the fact that this was the first area test in the brucellosis eradication program. Many factors such as herd isolation, low rate of herd additions from outside sources, and management practices must be considered in this regard.

The 1.25 percent animal infection rate in the herds in which 1 to 25 percent of the animals are vaccinated is highest of all classes as might be anticipated. As the percent of vaccinated animals in the herd increases, the percent of infected animals decreases until we have only 0.26 percent of the animals infected in the 100 percent vaccinated herds. Some of the 100 percent vaccinated herds have been vaccinating calves for as long as 20 years.

Of interest is the fact that as the percentage of vaccination increases, the percent of suspects decreases. This seems to support the hypothesis that vaccinal titers do not contribute appreciably to the problem of suspects.

TABLE II
Brucellosis as Distributed Through Total Cattle Population in
Relation to Herd Vaccination Practices

Herd vaccination status	Total Animals		Negative		Reactors		Suspects	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Nonvaccinated	455,658	47.91	445,320	97.73	4,832	1.06	5,506	1.21
1-25 pct. vaccinated	185,891	19.55	180,110	96.89	2,322	1.25	3,459	1.86
26-50 " "	78,971	8.30	76,917	97.40	707	0.90	1,347	1.70
51-75 " "	46,871	4.93	45,835	97.79	351	0.75	685	1.46
76-99 " "	26,535	2.79	26,123	98.45	110	0.41	302	1.14
100 " "	157,088	16.52	155,475	98.97	408	0.26	1,205	0.77
Totals	951,014	100	929,780	97.77	8,730	0.92	12,504	1.31

TABLE II-A

Herd group	Total Animals		Negative		Reactors		Suspects	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
All partially vaccinated herds	338,268	35.57	328,985	97.26	3,490	1.03	5,793	1.71
All nonvaccinated and partially vaccinated herds	793,926	83.48	774,305	97.53	8,322	1.05	11,299	1.42

We may ask ourselves, "If the number of infected animals can be expected to be about 80 percent less among vaccinated cattle than among nonvaccinated cattle, why is it that we have only an approximate 23 percent reduction in the number of infected herds following prolonged vaccination programs?" The answer to this question seems to be conditioned on the fact that the protection offered by vaccination in the face of known exposure is only 60 to 65 percent. The 35 to 40 percent of vaccinated animals which are still susceptible, being evenly distributed throughout the entire herd population, serve to perpetuate the disease among vaccinated populations. They pose a threat of exposure to nonvaccinated contacts as well. To discontinue vaccination in a formerly infected herd, then, would be an invitation for the disease to break out and spread unless a test and slaughter program were incorporated, along with isolation and testing of all purchased herd additions. Vaccination must be encouraged until the possibility of exposure is eliminated through an effective nationwide eradication program incorporating all of the tools we now possess for combating brucellosis.

Table IIA contains a portion of the same information as Table II, but it is grouped according to two collective classifications. The first, "All Partially Vaccinated Herds" contains a summary of the cattle which are in the 1 to 99 percent partially vaccinated herds. The second, "All Nonvaccinated and Partially Vaccinated Herds", includes all animals other than those in 100 percent vaccinated herds. These two classifications allow interesting comparisons.

Table III presents the distribution of reactors and suspects between the vaccinated and nonvaccinated populations within partially vaccinated reactor herds. Since exposure opportunity has been equal within each herd, it follows that equal exposure opportunity would apply to both groups collectively. A total of 915 partially vaccinated infected beef herds, containing 84,404 beef cattle, were surveyed on the initial brucellosis test in the Montana area eradication program. At that time, 26.67 percent of the cattle in partially vaccinated herds were vaccinated. Among the nonvaccinated cattle, 5.00 percent were reactors. This compares with 1.75 percent among the vaccinated animals. Applying the infection rate of 5.00 percent (which would be assumed to be the rate of infection if there were no vaccinations) we would have an expected 1,125 reactors rather than the actual 394. Thus, 731 animals which would probably have been infected were protected from the disease. This is a protection rate of 65 percent in the face of known brucellosis exposure.

Table IIIA gives a population summary within the 185 infected herds in the 100 percent vaccinated category. 1.99 percent of the cattle in these herds were reactors. Applying the infection rate of 5.00 percent (derived from the percent of reactors among the nonvaccinated population in partially vaccinated reactor herds), we would have an expected 1,024 reactors rather than the actual 408. Thus, 616 animals that probably would have been infected were protected from the disease. This is a protection rate of 60 percent in the face of known brucellosis exposure. It is surprising to note that the protection rate among vaccinated animals in the 100 percent vaccinated herds is 5 percent lower than the protection rate among vaccinated animals in the partially vaccinated herds. However, there were a few herds in the 100 percent vaccinated group which were heavily infected. One such herd had 36 reactors and

TABLE III

Distribution of Reactors and Suspects Among Vaccinated and Nonvaccinated Populations
Within All Partially Vaccinated Reactor Herds

Cattle	Total		Negative		Suspects		Reactors	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Nonvaccinated	61,896	73.33	55,630	89.88	3,170	5.12	3,096	5.00
Vaccinated	22,508	26.67	21,532	95.67	582	2.58	394	1.75
Totals	84,404	100.00	77,162	91.43	3,752	4.44	3,490	4.13

TABLE III-A

Brucellosis Reactors and Suspects Among the 100 Percent Vaccinated Herds

Cattle	Total		Negative		Suspects		Reactors	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
100 percent vaccinated	20,471	100.0	19,495	95.23	568	2.78	408	1.99

42 suspects among 248 head of cattle. Apparently the virulence of the organism and exposure opportunity were overwhelming in this particular herd. Such special circumstances must not cause us to reject vaccination. Later tests in this herd show the infection to be almost wiped out through a program of testing, with slaughter of infected animals, and continuing vaccination of replacement calves.

Table IV gives a detailed breakdown of the brucellosis incidence within vaccinated and nonvaccinated populations, and in all six classifications of herds. The herd classifications are the same as those previously set forth in Tables I and II.

It is significant that there is no appreciable difference in the infection rate among the nonvaccinated populations within the various classifications of herds. In the 76 to 99 percent vaccinated herds, we find an infection rate of 1.16 percent among the nonvaccinated animals. This is greater than the rate in the nonvaccinated herds, and almost as high as the 1.32 percent infection rate among the nonvaccinates in the 1 to 25 percent vaccinated herds. In other words, there is no appreciable protection for nonvaccinates, regardless of the percentage of vaccinated animals in the herd. This points up the fact that to be effective a vaccination program must include 100 percent of the replacement calves.

In contrast, we note that there is a substantial decline in the infection rate among vaccinated animals as the percentage of vaccinated animals within the herd increases. This would seem to bear out the hypothesis that the higher the percentage

of vaccinated animals within a herd, the more effective is the protection afforded each animal vaccinated. However, in the 100 percent vaccinated group we still have an infection rate of a little more than two-fifths that of the rate in vaccinated animals in the 1 to 25 percent vaccinated herd classification.

TABLE IV

Brucellosis as Distributed Through the Nonvaccinated and Vaccinated Cattle Populations in Relation to Herd Vaccination Practices

Herd vaccination status	Nonvaccinated Animals							
	Negative		Reactors		Suspects		Totals	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Nonvaccinated	445,320	97.73	4,832	1.06	5,506	1.21	455,658	65.54
1-25 pct. vaccinated	162,854	96.80	2,214	1.32	3,161	1.88	168,229	24.20
26-50 " "	48,362	96.71	613	1.23	1,031	2.06	50,006	7.19
51-75 " "	16,918	96.76	224	1.28	342	1.96	17,484	2.51
76-99 " "	3,742	96.44	45	1.16	93	2.40	3,880	0.56
Totals	677,196	97.40	7,928	1.14	10,133	1.46	695,257	100
	Vaccinated Animals							
1-25 pct. vaccinated	17,256	97.70	108	0.61	298	1.69	17,662	6.90
26-50 " "	28,555	98.59	94	0.32	316	1.09	28,965	11.33
51-75 " "	28,917	98.40	127	0.43	343	1.17	29,387	11.49
76-99 " "	22,381	98.79	65	0.29	209	0.92	22,655	8.86
100 " "	155,475	98.97	408	0.26	1,205	0.77	157,088	61.42
Totals	252,584	98.76	802	0.31	2,371	0.93	255,757	100

SUMMARY

To determine the efficiency of Brucella abortus Strain 19 vaccine in beef cattle, a comprehensive survey was conducted in the State of Montana at the time of the first area test for certification. Data on 951,014 cattle in 21,418 herds are presented. The vaccination status of each animal was determined at the time of test. The data are analyzed on the basis of percentage of animals vaccinated within each herd, and comparisons of vaccinated and nonvaccinated populations. The following facts are evident:

1. The herd infection rate was only 23 percent lower in those herds in which all animals were vaccinated than it was in those herds in which none of the cattle were vaccinated.

2. The infection rate within the entire vaccinated cattle population was approximately 80 percent lower than that within the entire nonvaccinated population.
3. Vaccinal titers were not a primary cause for the presence of suspect animals in herds containing suspects, but no reactors.
4. Suspects occurred 36 percent less frequently within the vaccinated population than within the nonvaccinated population.
5. In partially vaccinated infected herds, brucellosis occurred 65 percent less frequently within the vaccinated population than it did within the nonvaccinated population. This, then, is a protection rate of 65 percent in the face of known exposure.
6. In infected herds in which all animals were vaccinated, brucellosis occurred 60 percent less frequently than it did within nonvaccinated cattle in partially vaccinated infected herds.
7. The relative protection afforded by Strain 19 vaccine did not influence the rate of infection within nonvaccinated populations in infected herds, regardless of the percent of animals vaccinated.
8. Vaccination alone cannot be expected to eradicate brucellosis nor to free the majority of infected herds from the disease. Infected animals must be identified and eliminated.
9. Vaccination is very useful in building the resistance of susceptible animals against brucellosis, but its limitations must be recognized.

